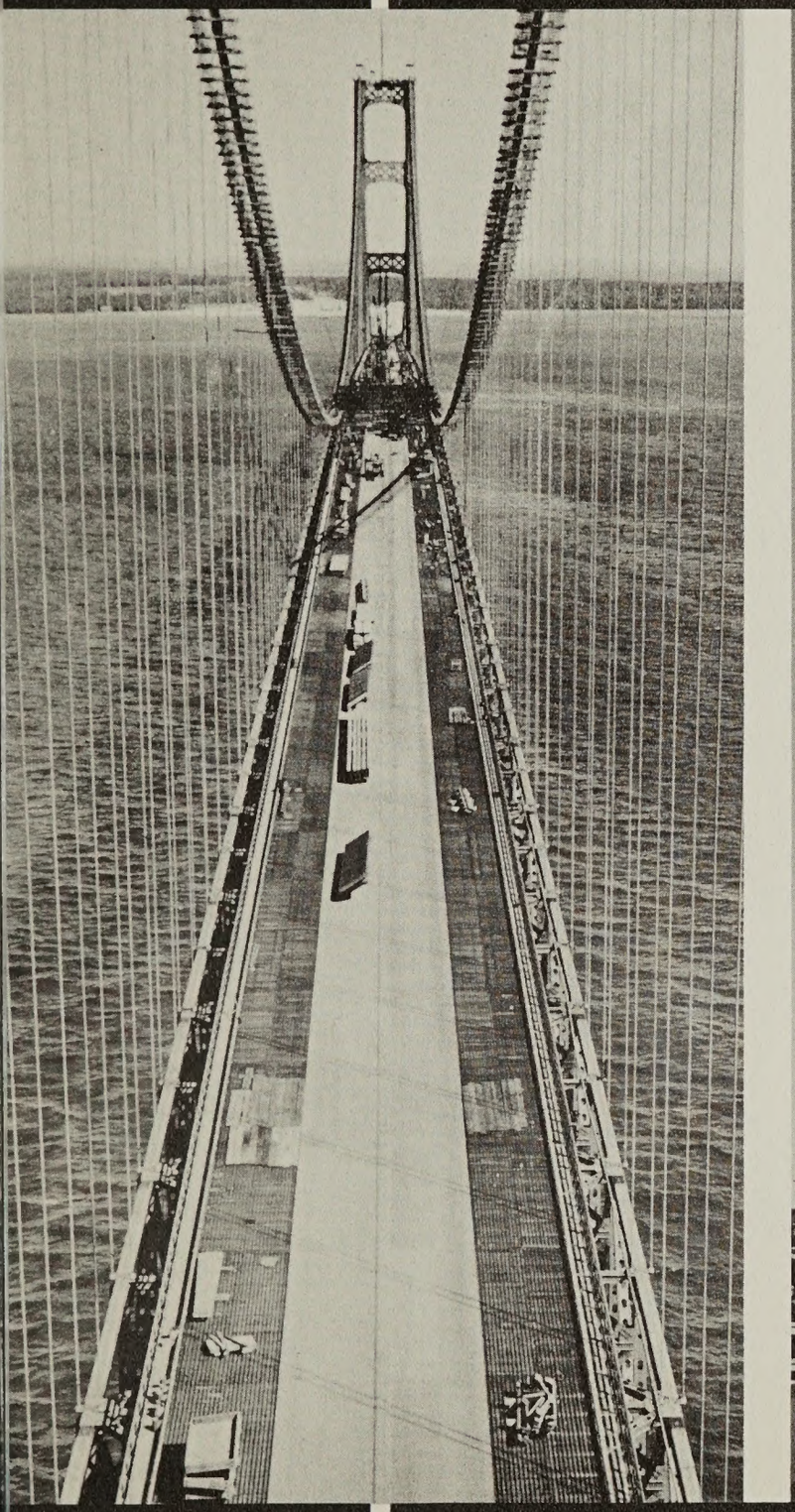
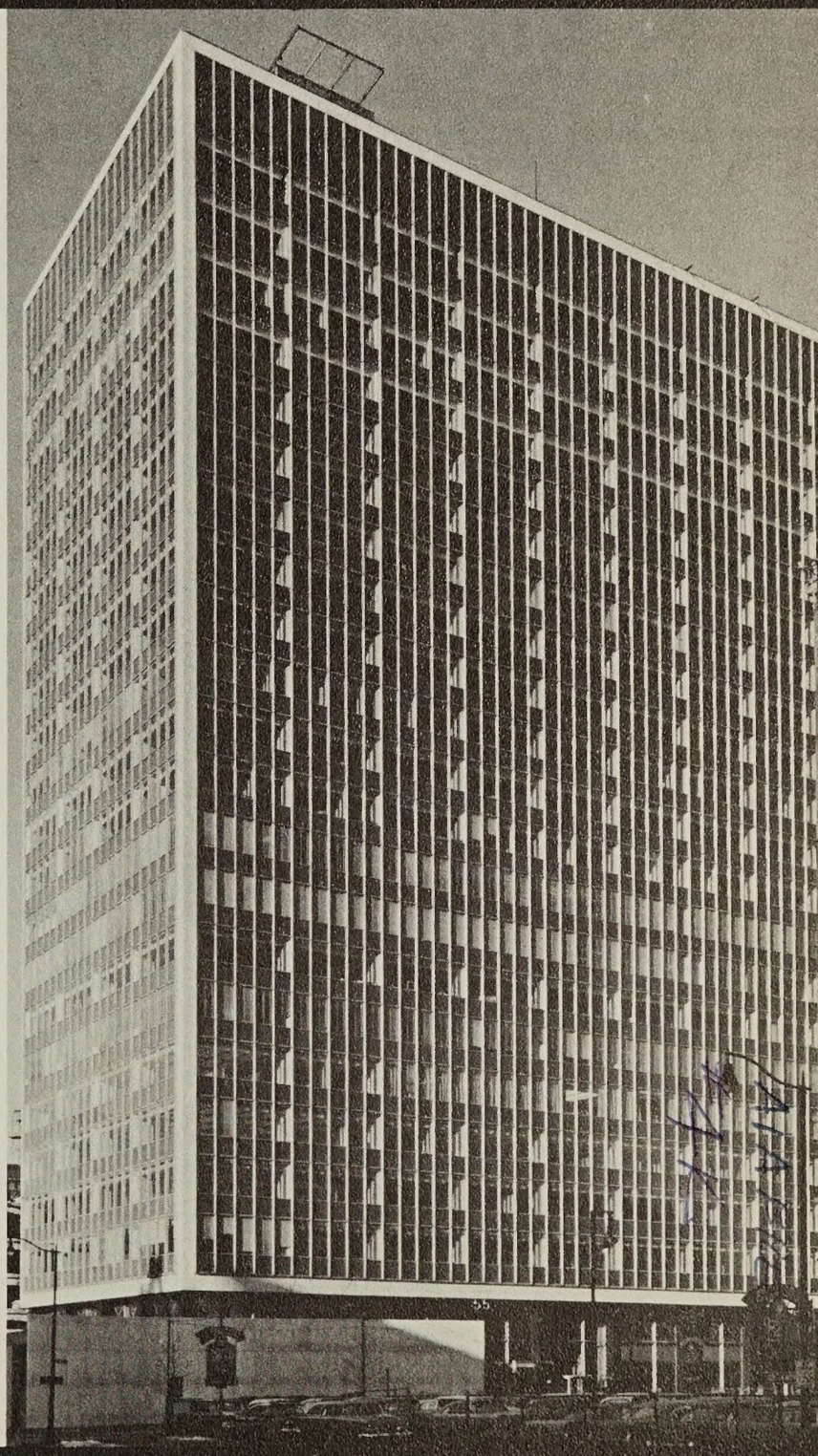
Master Builders Reporter No. 14

POZZOLITH® Employed In Lightweight Concrete For Increased Workability—Improved Quality





THE MASTER BUILDERS CO.

Division of American-Marietta Company

CLEVELAND 3, OHIO

The Master Builders Co., Ltd.
Toronto 9, Ontario

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New York 17, N.Y.

Introduction . . .

In recent years the attention of architects and engineers has been focused on the use of lightweight aggregate concrete as a structural material.

The projects featured in this book were selected to be representative of the many thousands of structures where *Pozzolith** has been successfully employed to improve the quality of lightweight concrete. The lack of workability, so characteristic of most lightweight aggregate concrete mixes, is readily overcome with *Pozzolith*. The water reduction obtained with *Pozzolith* is a vital aid in minimizing segregation, reducing bleeding and reducing shrinkage to acceptable limits.

The following stories clearly illustrate the role played by *Pozzolith* in obtaining uniform, better quality lightweight aggregate concrete at lowest cost-in-place.

*POZZOLITH is a registered trademark af The Master Builders Ca.

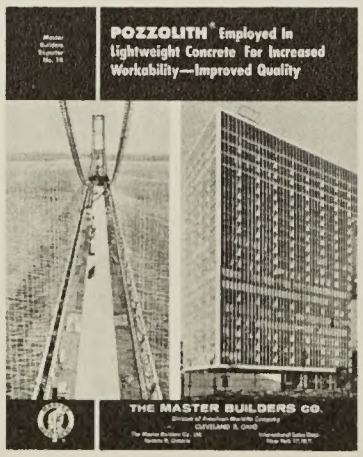
Contents . . .

	page
The Illuminating Building, Cleveland	3
Stephen F. Austin Jr. High School Midland, Texas	6
Hayward Place Garage, Boston	8
The Mackinac Bridge, Mackinac Straits	10
Commerce Building, New Orleans	12
Jackson Parking Garage, Dallas	14
Halle Bros. Addition, Cleveland	16
General Petroleum Building, Los Angeles	17
Continental Bank Building, Ft. Worth	18
Fulton Bank Building, Atlanta	18
Memorial Auditorium, Dallas	19
Barnhart Island Bridge, St. Lawrence Seaway	19
CAA Warehouse, Oklahoma City	19
Pozzolith Benefits	20

on the cover . . .

LEFT PHOTO:
Mackinac Bridge,
Straits af Mackinac,
Michigan.
Stary page 10.

RIGHT PHOTO:
Illuminating Building,
Cleveland, Ohia
Stary an page 3.



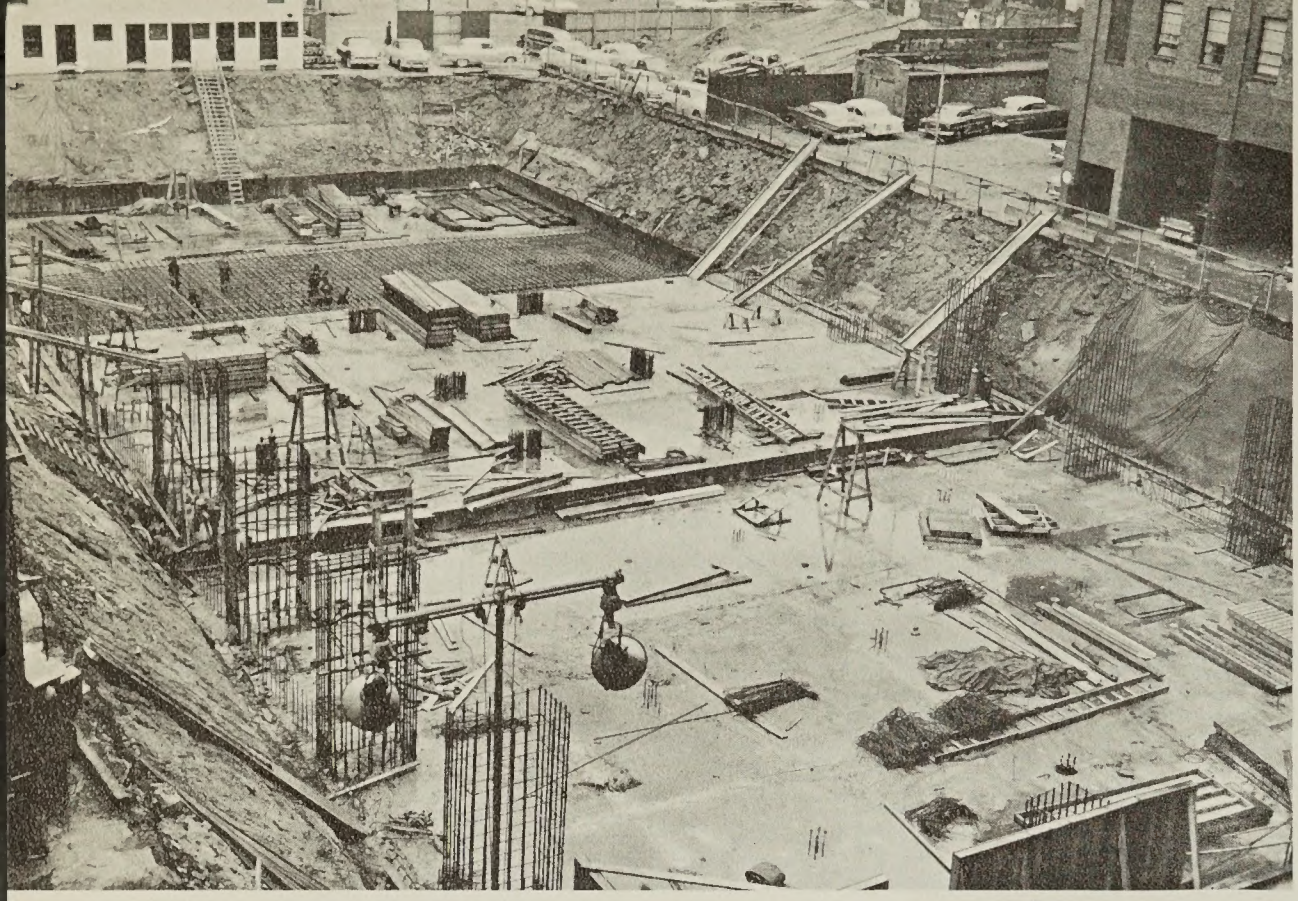
© 1958, The Master Builders Ca.

The new Illuminating Building makes a striking contrast to Cleveland's skyline.

POZZOLITH Employed To Improve Quality Of LIGHTWEIGHT CONCRETE For Cleveland's 24-Story Illuminating Building

The first major skyscraper in the downtown Cleveland area, since the construction of the Terminal group in 1930, is presenting its gleaming glass and aluminum face to Cleveland's famous Public Square. Rising 24 stories above street level, this modern structure provides 400,000 square feet of valuable office space.

The normal difficult foundation problems encountered in the downtown area precluded anchoring the structure to bedrock, which is located 206 feet below ground level. The building is "floated" on a reinforced concrete mat, as are most structures in



For the reinforced cancrete faundotian slab, 3650 cubic yards af lightweight cancrete and appraximately 600 tons of reinfarcing steel were used.

the downtown area. The one exception is the Terminal group, which is anchored to bedrock by caissons.

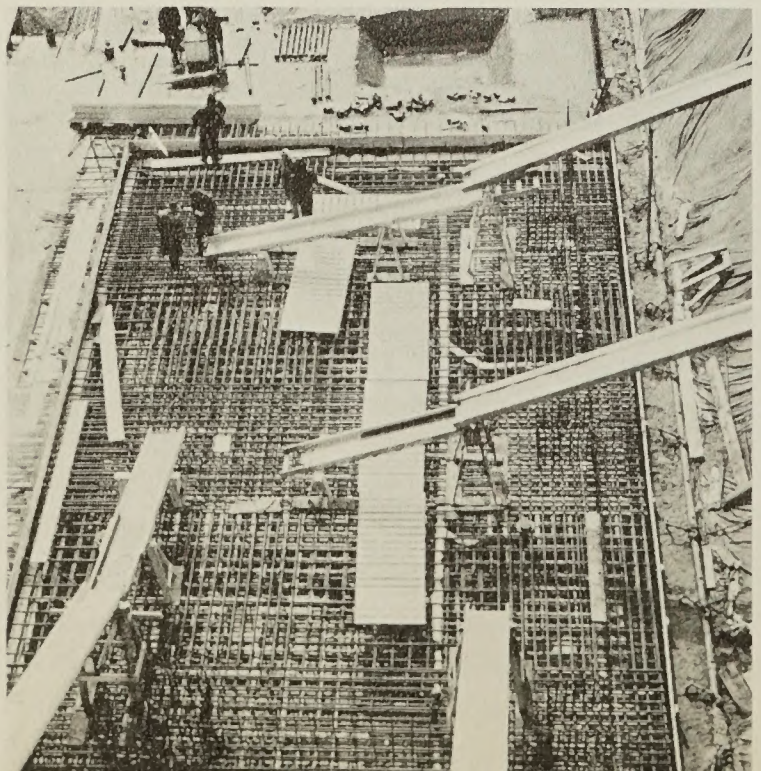
Examination of the soil and test borings indicated that the full height of the structure could not be achieved with standard weight reinforced concrete. By utilizing lightweight concrete, even in the 4½ foot thick foundation mat, the building weight was held to approximately 87,650,000 pounds, or about four-fifths the weight of an equivalent standard concrete structure.

Pozzolith was employed in the lightweight structural concrete to obtain the required workability with a minimum amount of water. Expanded shale aggregate, both coarse and fine, was utilized to hold the unit weight of the concrete to the specified 102 pounds per cubic foot. With 6 bags of cement and *Pozzolith*, this lightweight concrete averaged 3750 psi compressive strength in 28 days, well above the 3000 psi specified. This mix was easily placed, and in the hardened state exhibited a smooth texture free from cracks and surface defects.

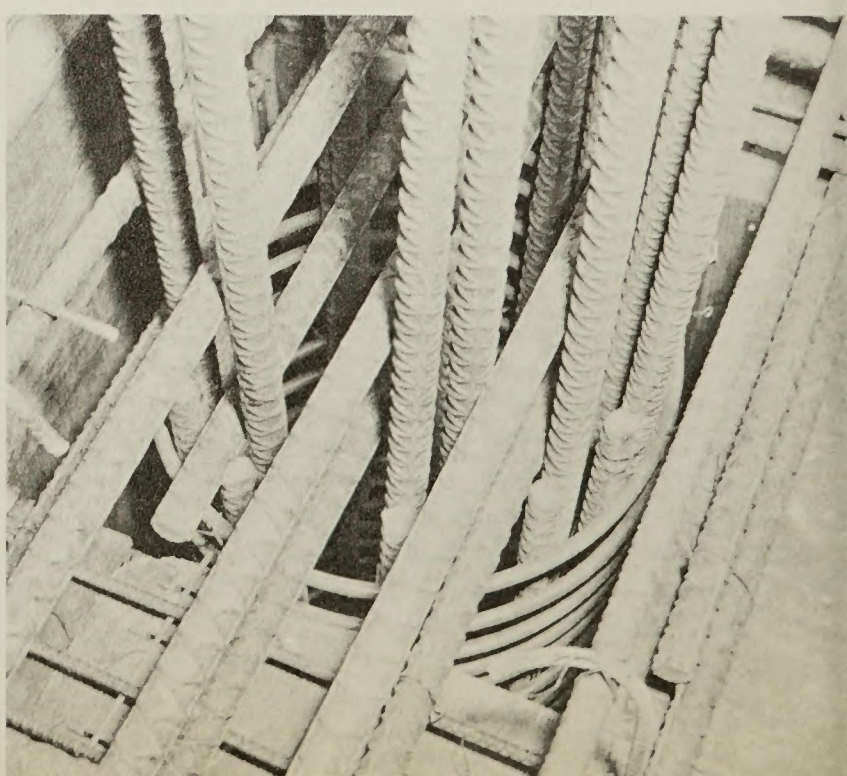
The "floating" mat, which supports the structure, is located 18 feet below street level and four feet below the water table in that area. This necessitated the use of a well point and pumping system to lower the water table until the sewers and foundation mat were completed.

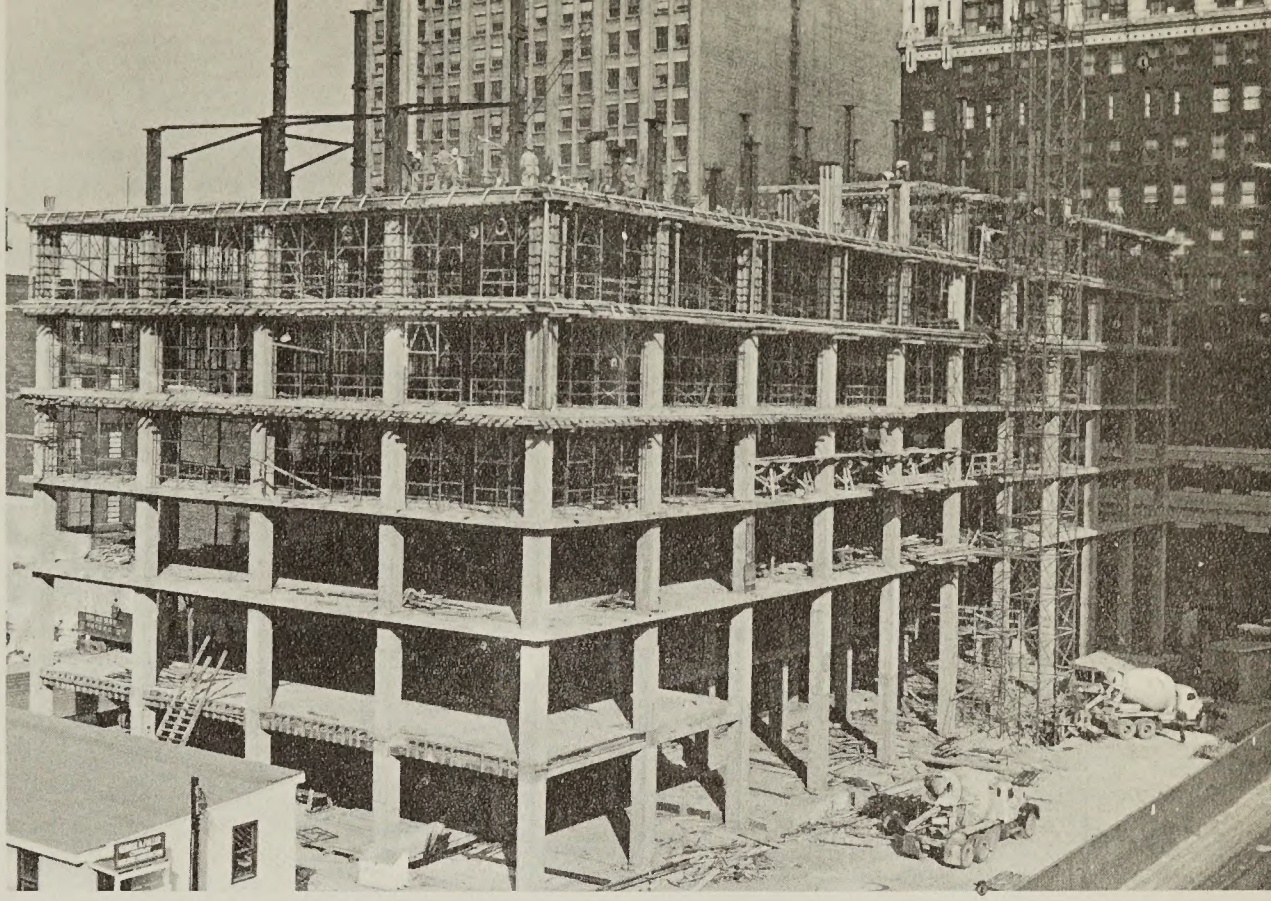
The mat itself required 3650 cubic yards of lightweight concrete and approximately 600 tons of

Reinfarcing steel far slab priar ta placing cancrete.



Detail af column and slab reinfarcement.





Construction view showing mixer trucks delivering concrete to elevotor. With POZZOLITH, this lightweight oggregote concrete retoined its workability throughout multiple hondling ond plocing operotions.

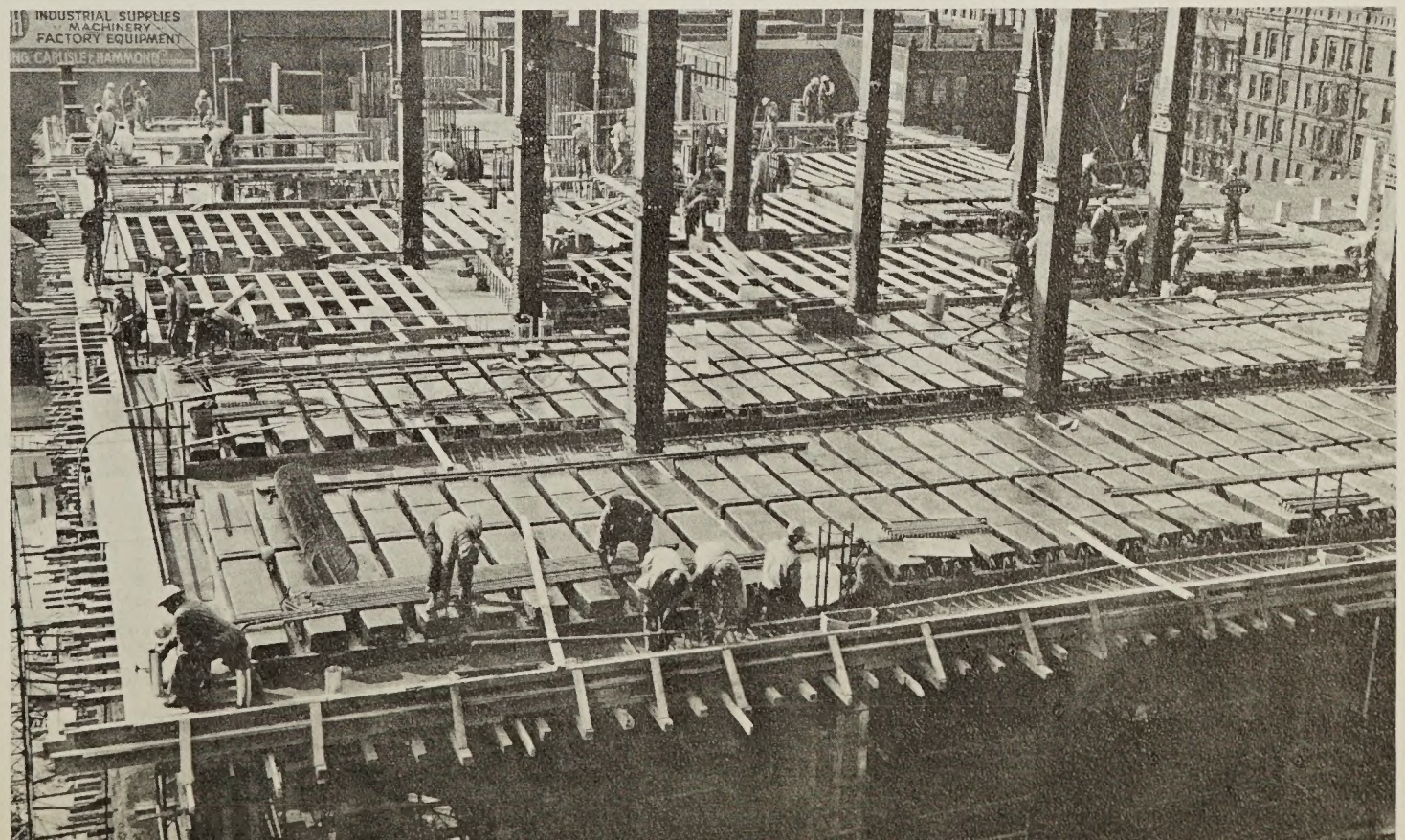
reinforcing steel. The increased workability provided by *Pozzolith* aided greatly in the placement and consolidation of the mix in this heavily reinforced mat.

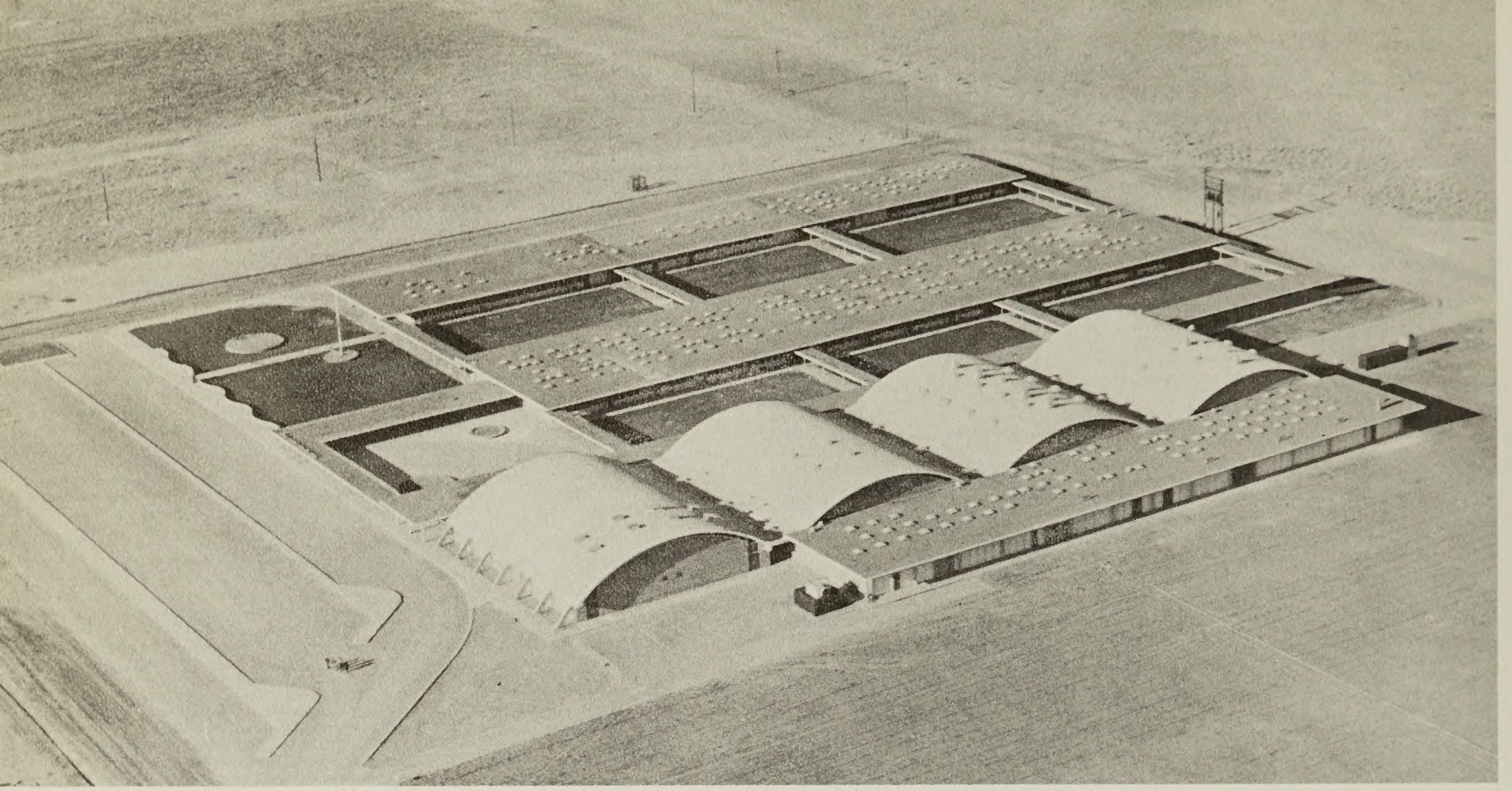
The modern air conditioning design incorporated in the building is comprised of two systems, one for the exterior zone which compensates for the varying effects of sun, wind and weather, and an interior system for areas away from the exterior walls. This design helps prevent any deviation from the desired indoor climate.

One of the outstanding architectural features is the 65 by 300 foot plaza which includes a large reflecting pool and planted flowers and shrubs, on the Public Square side of the building. This feature plus the forty-foot high glass facade at ground level make this structure one of the outstanding landmarks in the Cleveland area. Field service by The Master Builders Co., Cleveland Office.

Archt.: Carson & Lundin, New York.
Engr.: McGeorge-Hargett & Associates, Cleveland.
Contr.: George A. Fuller Company, New York.
Pozzolith Ready-Mixed Concrete: Cleveland Builders Supply Company.

Formwork going into ploce for floor ond columns.

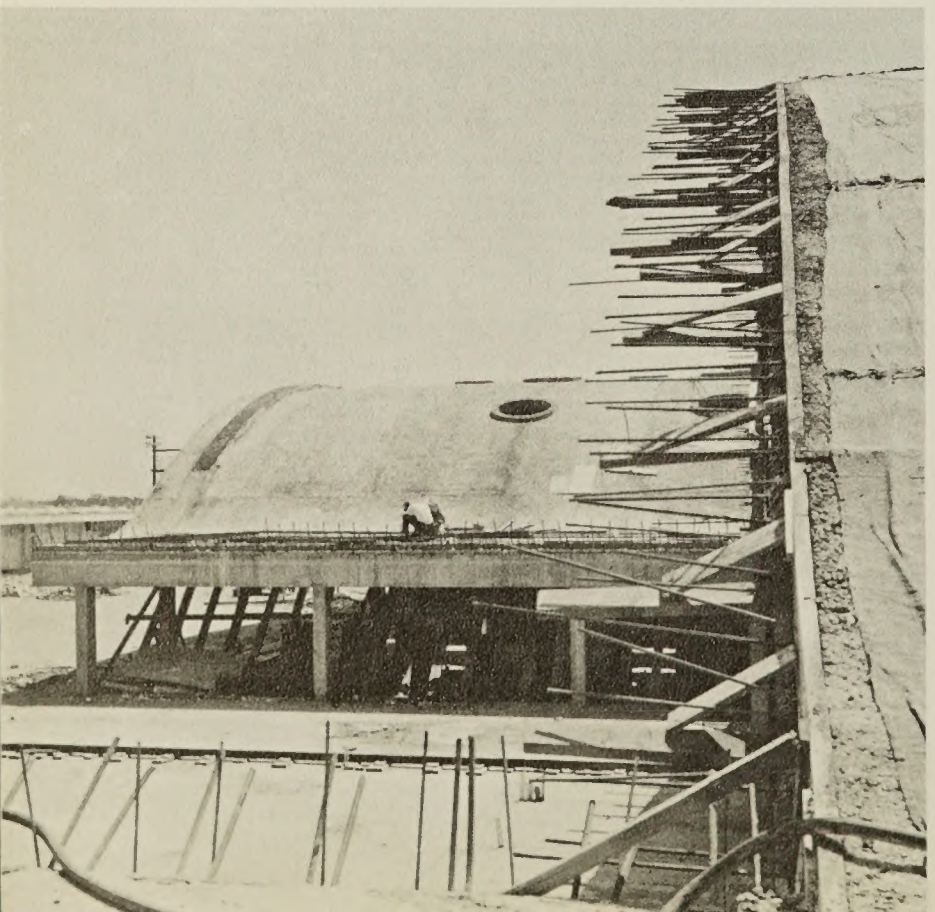




Concrete roof structures afforded optimum economy in design of this 1200 student school.

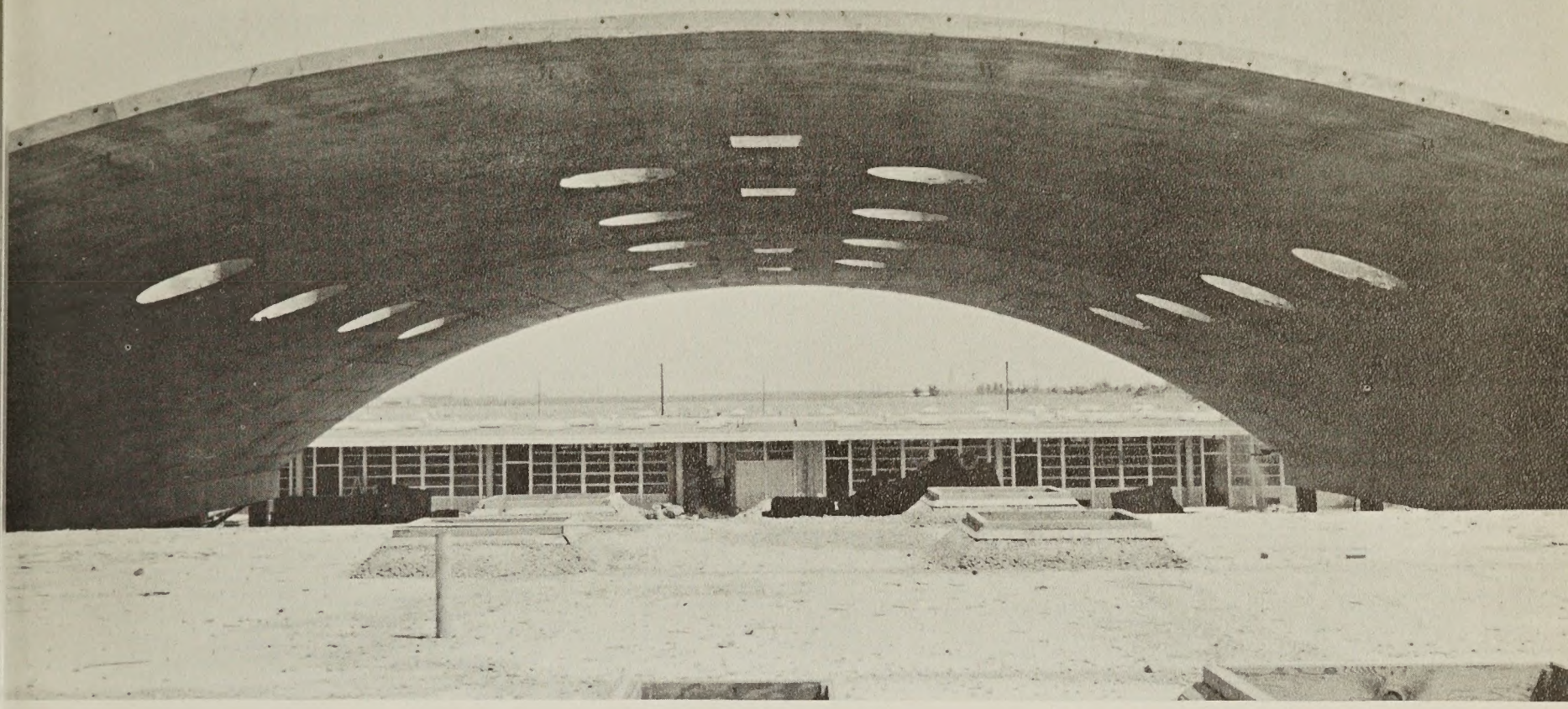
POZZOLITH Aids Early Strength Development Of Lightweight Concrete For ARCH ROOFED SCHOOL

View of roof section under construction.



The Stephen F. Austin Junior High School at Midland, Texas was designed with all-concrete roofs, to take full advantage of the economies offered by this type of construction. The classroom and administration sections of the 1200 student school were readily adapted to flat slab roof construction and expanded shale aggregate concrete was specified for these slabs. *Pozzolith* aided in achieving the 3000 psi compressive strength required for these roofs.

The auditorium, music building, boys' gym, girls' gym and cafeteria required long, broad floor areas unobstructed by columns or interior supports. To meet this need, a ribless concrete arch roof, 80 feet by 105 feet was designed for each of these structures. The arch roofs have a 14 foot rise on a 64 foot radius over their 80 foot width. These lightweight concrete roofs are 6 inches thick and were placed on a movable form in two sections for each roof. A compressive strength of 3750 psi before removal of forms, was specified.

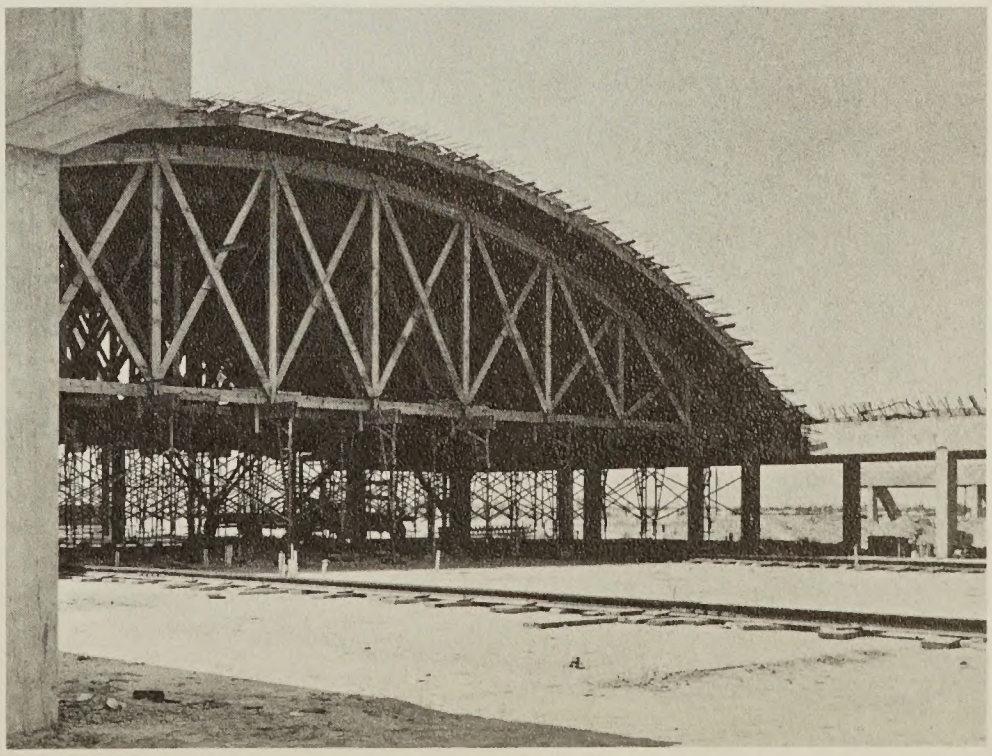


With POZZOLITH the required 3750 psi was obtained in 4 to 7 days.

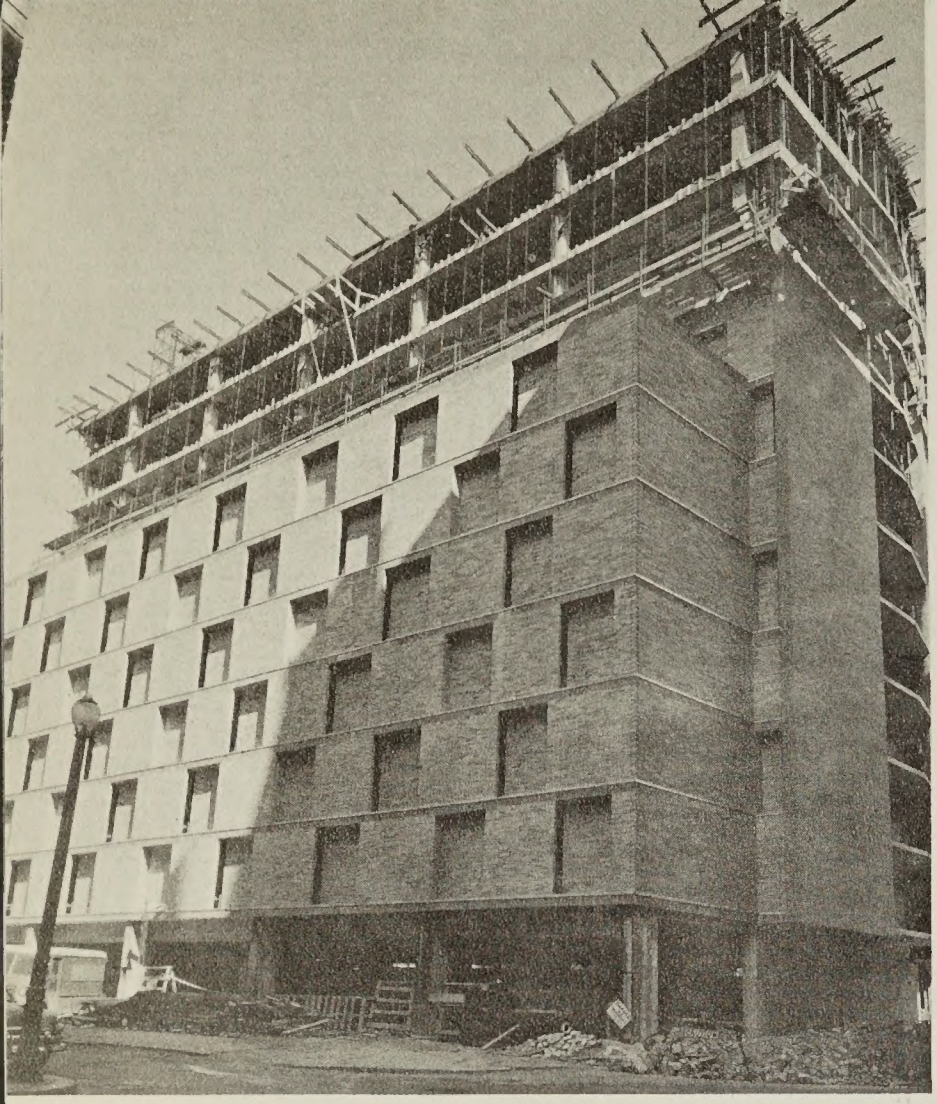
With *Pozzolith* and Type III cement, this requirement was readily met in less than seven days, and the 28 day strength of this lightweight concrete was well over 5000 psi. The unit weight of this lightweight concrete was held to 100 lbs. per cubic foot.

Maximum workability with low slump allowed placing of the arch concrete to proceed almost as rapidly as for the flat slabs, with the concrete readily holding place on the sloping arch surfaces. After hardening, the arch concrete roofs were free from cracks, indicating a very low shrinkage coefficient for the concrete. Concrete was placed for the arch sections during warm weather, and *Pozzolith* Retarder was used to control setting of high early strength concrete until placement was completed. Both field and laboratory control was provided by Southwestern Testing Laboratories and consistent and predictable results were obtained throughout the project. Field service by The Master Builders Co., Oklahoma City Office.

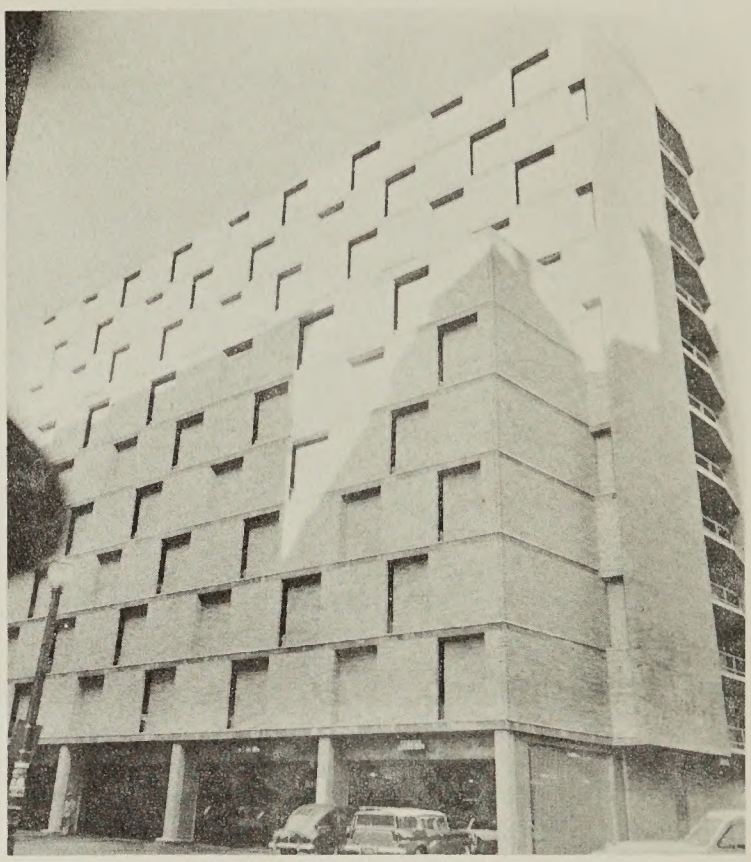
Archt.: Pierce, Norris, McCutchan, Pace & Associates, Midland, Texas.
Struct. Engr.: C. W. Ellis, Midland, Texas.
Contr.: Warner Construction Co., San Angelo, Texas.
Pozzolith Ready-Mixed Concrete: Pannell Brothers Concrete Company, Midland, Texas.



Movable form focilitoted stripping ond positioning for next plocement.



Five high-speed elevators make it possible to handle 3000 cars daily.



POZZOLITH And MASTERPLATE Used To Produce ABRASION RESISTANT LIGHTWEIGHT CONCRETE Floor Slabs In Boston Garage

The Hayward Place Garage, located in the heart of Boston's retail shopping area, presents considerable interest in its pleasing architectural treatment and in the effective use of lightweight concrete in construction. The garage is 13 stories high, operates mechanically, provides parking space for over 700 cars, and with 5 high-speed elevators, is capable of handling 3000 cars daily.

The design called for standard weight concrete columns and lightweight concrete beams and floor slabs. The use of lightweight concrete in the floor slabs presented obvious weight saving advantages.

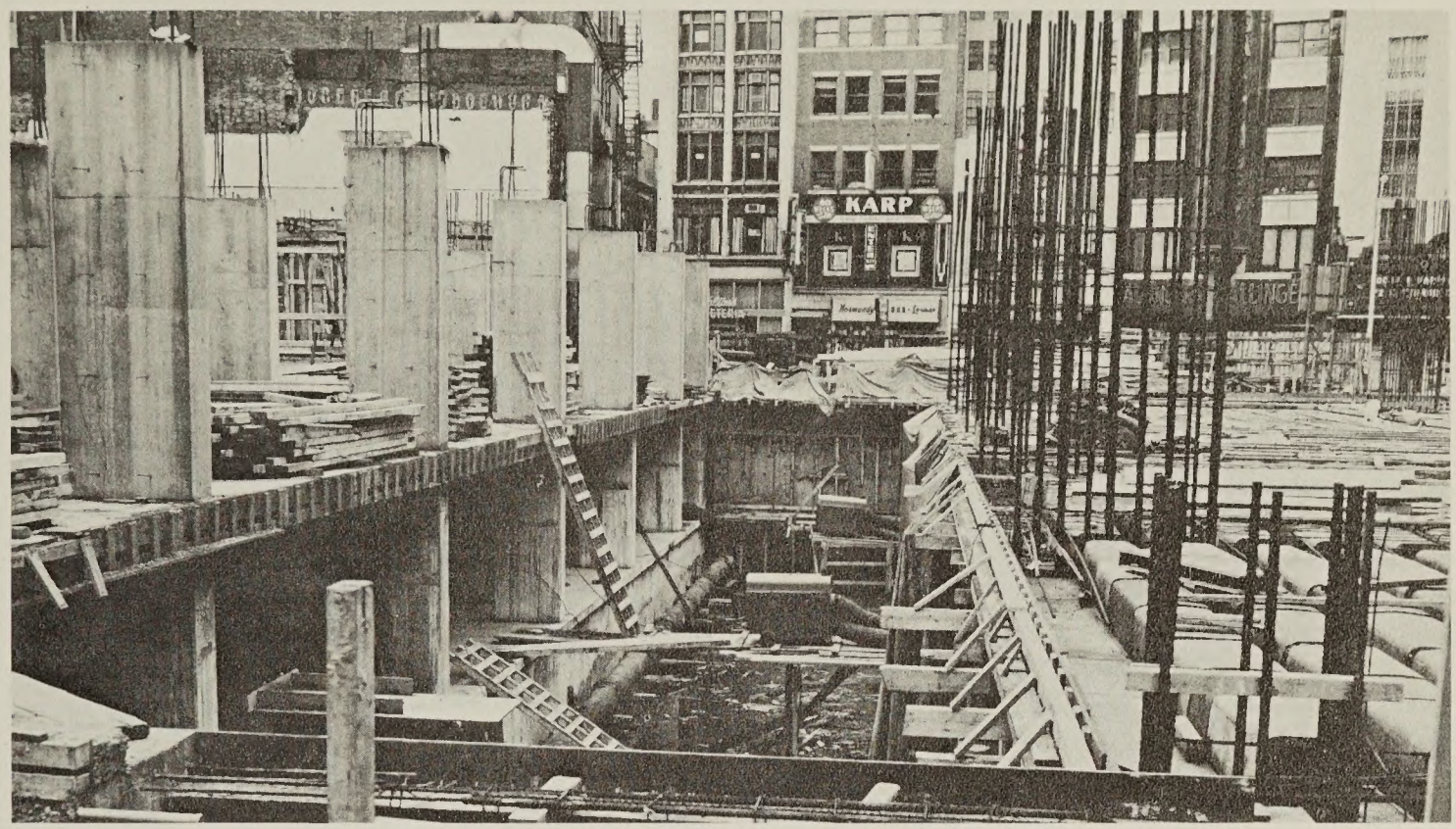
However, abrasion resistance of the garage floors was an important consideration. Snow, ice, automobile tire chains, and sand carried in from the streets presented an obvious abrasion problem. To solve this, floor slabs were finished with *Masterplate** metallic aggregate. This produced an "iron-clad", abrasive resistant floor, easy to clean, and capable of withstanding this hard wear while still maintaining minimum weights.

Specifications for lightweight concrete called for 3000 psi compressive strength at 28 days, and a maximum weight (dry) of 110 lbs. per cubic foot. A representative lightweight mix consisted of:

Cement	600 lbs.
Damp Sand	1350 lbs.
Expanded Shale Aggregate (damp)	1050 lbs.
Water/Cement Ratio	6.2 gals./bag

Plus *Pozzolith*

*Registered trademark.

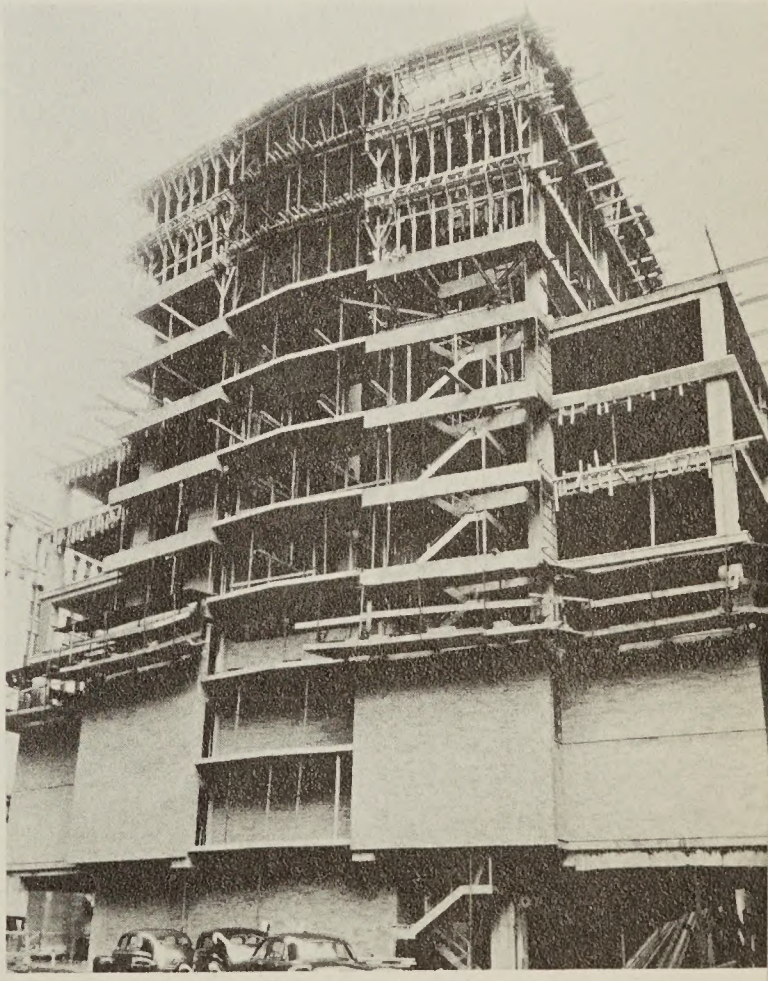


View showing columns under construction.

Uniform results were obtained, with 28 day strengths running from 3600 to 3800 psi. Good workability was obtained, with no segregation. In mixes placed at 3½ inch slump or less, bleeding was not encountered. This lightweight mix was consolidated, using internal low frequency (3000 v.p.m.) vibration. Exposed slab edges, which add to the appearance of the outside walls, exhibit smooth, uniform finish.

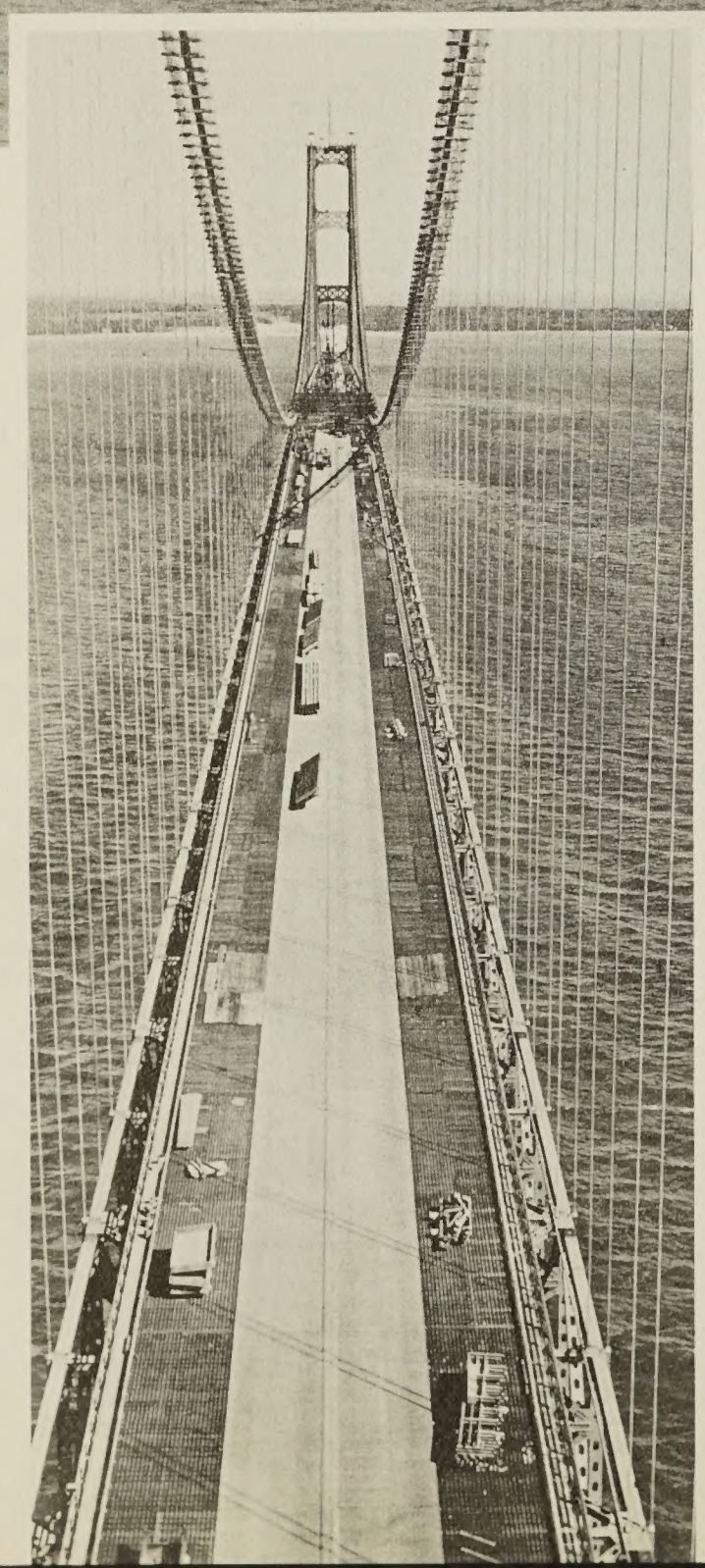
The garage walls are of tan brick masonry construction. Using a staggered panel arrangement, light and ventilation are provided, while the 8 by 10 foot panels serve as weather protection. Field service by The Master Builders Co., Boston Office.

Owner: City of Boston.
Archt.: William Nelson Jacobs Associates, Inc., Joseph L. Eldridge, AIA, Boston.
Struct. Engr.: Goldberg LeMessurier & Associates, Boston.
Gen. Contr.: S. & A. Allen Construction Company, Charlestown, Mass.
Materials Technologist: Herman G. Protze, Boston.
Pozzolith Ready-Mixed Concrete: Boston Sand & Gravel Company.



Edges of floor slobs ore exposed on exterior wolls. POZZOLITH helped obtoin the smooth finish desired for this orchitecturol concrete.

Main span of the Mackinac Bridge is 3800 feet lang. Overall bridge length

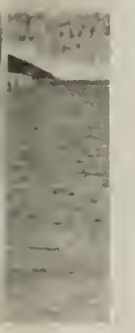


POZZOLITH Employed In L For Workability And To Of Floor Slabs

In the construction of the $100 million Mackinac Bridge, a combination of open type and concrete-filled steel grating bridge flooring was used to obtain a suspended span roadway with minimum dead weight.

Pozzolith was employed in the lightweight concrete for the filled grating sections to provide a workable, cohesive mix, of minimum shrinkage. Workability was important, as a concrete mix was needed that would readily consolidate in and around both the steel grid shapes and internal reinforcing bars. Concrete was placed at slumps ranging from 2½ to 3 inches. The 4¼ inch thick slabs were finished using a vibrating screed. Concrete specifications called for the lightweight concrete to attain a compressive strength of 3000 psi at 28 days and to have

Outer traffic lanes are surfoced. Inner lanes are af apen steel construction.



,444 feet.

htweight Concrete
REDUCE SHRINKAGE
n Mackinac Bridge

an approximate weight of 108 lbs. per cubic foot. Proportions of a 1-cubic yard mix are given below:

Type 1A Cement	611 lbs.
Fine Aggregate	1570 lbs.
Coarse Aggregate	450 lbs.
Water	233 lbs.
Air	6%
Plus *Pozzolith*	

Test cylinders of this mix averaged 2830 psi at 7 days, and 4250 psi at 28 days.

The two inner traffic lanes, each 11 feet wide, and a 2 foot raised center dividing strip are of open steel grating construction. The openings in this type of steel grid flooring provide drainage, prevent build-up of heavy snow accumulations on the roadway, and offer improved aerodynamic stability to the structure.

Workability wos measured by Kelly Ball determinotion. POZZOLITH helped obtain the workobility needed for complete consolidotion of the mix while keeping woter content within practicoble limits. Plocement wos aided by a vibrating screed.

The two outer traffic lanes, each 12 feet wide, consist of fabricated steel grating floor sections with light-gage steel form pans at the bottom. When filled with lightweight concrete, the grid forms an integral slab of concrete and steel. Field service by The Master Builders Co., Detroit Office.

Owner: Mackinac Bridge Authority.
Consult. Engr.: Dr. David B. Steinman.
Assoc. Consult.: Glenn B. Woodruff.
Substruct. Contr.: Merritt-Chapman & Scott Corp.
Superstruct. Contr.: American Bridge Division, United States Steel Corp.
Suspended Span Deck Contr.: Louis Garavaglia Company, Center Line, Mich.

Warkability and strength were readily attained with POZZOLITH in lightweight aggregate concrete far New Orleans' tallest all-concrete building.

Lightweight Concrete For 18-Story Structure Readily Placed With Aid Of POZZOLITH

Thirteen floors of offices and five floors of parking area (250 cars) are incorporated into one structure in the Commerce Building in downtown New Orleans. Constructed of reinforced lightweight concrete, this building is the tallest all-concrete building in New Orleans.

Specifications for this lightweight concrete called for a compressive strength of 3750 psi in 28 days and limited the weight of the concrete to 105 lbs. per cubic foot. With *Pozzolith,* 6 bags of cement and expanded clay aggregate, both of these requirements were easily met. The workability necessary for placement was readily obtained with *Pozzolith* without the "extra" water usually needed for lightweight concrete mixes. Segregation, bleeding and shrinkage were substantially reduced.

The building is bordered on two sides by tall buildings and on a third side by a narrow alley which

limited access to the construction site. Tight scheduling by the contractor kept a steady flow of materials to the job. By using four work crews on one floor simultaneously (form work, steel erection, electrical installation, concreting), one floor was completed each week.

The lightweight concrete was delivered by ready-mix truck and chuted into an elevator hopper which transported the concrete to the working floor. There it was transferred to a holding hopper and dispensed into power-operated concrete buggies for delivery to the placing area. Consolidation was accomplished by the use of low frequency vibrators. The hardened concrete has a smooth finish free from honeycomb and surface defects.

Owner: Gravier Improvement Co., New Orleans.
Archt.: Nolan, Norman & Nolan, New Orleans.
Consult. Engr.: J. A. Miller & Associates, New Orleans.
Contr.: R. P. Farnsworth & Co., New Orleans.
Pozzolith Ready-Mixed Concrete: Jahncke Service, Incorporated, New Orleans.

POZZOLITH Aids Placing Of Lightweight Concrete During Hot Weather . . . 100° TEMPERATURE

The Jackson Street Parking Garage in Dallas, Texas, was built and opened for business two months after construction began. Actually, the 300 car, 65,000 square foot garage went up in only 27 working days. Lightweight concrete was used in both the structural concrete placed on the job site, and in the precast concrete units that made up a combined joist and slab section.

To erect the garage in this brief time, a planned construction sequence was followed. The majority of columns were placed using tubular fiber forms placed over the column reinforcing steel. Next, wooden forms were built for the overhead beams, and centered over the column forms. Precast joist and slab sections were placed spanning the beam forms, and then ready-mixed lightweight concrete was placed monolithically for the columns, beams and floor slab topping. In this way, the columns, beams and precast units form an integral unit.

Air temperatures at the time of placement ranged between 100° and 105°, which increased the danger of cold joints in this type of construction. The initial delay in hardening provided by *Pozzolith* Retarder overcame this problem, and placing operations were performed on a normal schedule despite the hot weather. *Pozzolith* also provided the required

Topping slab, columns and beams placed as one unit with the aid of POZZOLITH.

workability with reduced water-content, thereby increasing compressive strength and reducing segregation, bleeding and shrinkage. Low shrinkage was an important design consideration, as the concrete columns, beams and floor topping were placed as an integral unit.

Pozzolith also was employed in the manufacture of the precast lightweight concrete joist slabs. *Pozzolith* aided production of these units by permitting early removal from the forms and helped obtain the smooth, pleasing surface finish required for the units which are exposed to view. Field service by The Master Builders Co., Dallas Office.

Archt.: Jacob E. Anderson, Dallas.
Struct. Engr.: John A. Murlin.
Contr.: James Stewart Company, Dallas.
Lightweight Precast Concrete Joists: Texas Concrete Products Corp.
Pozzolith Ready-Mixed Concrete: Wamix, Inc. Dallas.

REFERENCE:

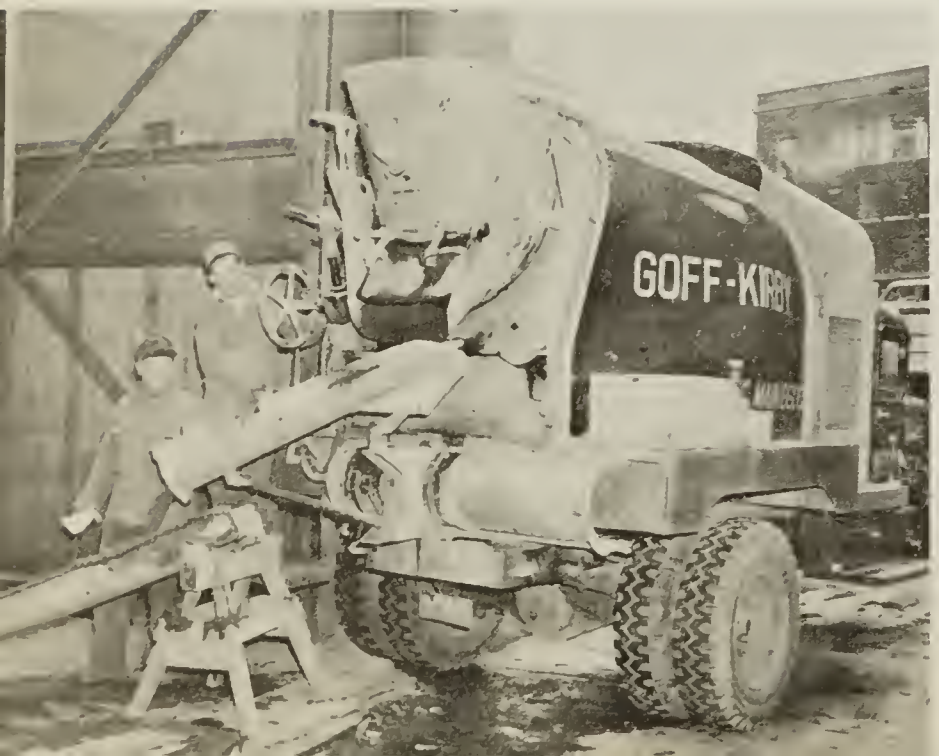
Architectural Record, May 1954, p. 198.

The annex building was designed to match the architecture of the existing building.

Lightweight Concrete With POZZOLITH REDUCED DEAD LOAD 8,000 Tons

In 1948, just prior to construction of the West Wing addition to the Halle Brothers store in downtown Cleveland, a change in plans increased dead load of the structure past the load bearing capacity of the soil.

Substituting lightweight concrete for standard concrete reduced the dead load 8,000 tons, more than enough to offset the increased weight due to the change in design. However, trial lightweight concrete mixes with sufficient water to attain the necessary workability for proper placement did not meet compressive strength requirements.



With *Pozzolith* added, compressive strengths were readily achieved, and the lightweight concrete mix was easily placed and consolidated. Workmen reported that this concrete mix exhibited no tendency to segregate and was easily finished.

Weight of the lightweight concrete for this 14-story structure ranged between 98 and 102 lbs. per cubic foot. Uniform compressive strengths, well above specification, were readily attained. Field service by The Master Builders Co., Cleveland Office.

Archt.: Walker & Weeks.
Contr.: Sam W. Emerson Company.
Pozzolith Ready-Mixed Concrete: Goff-Kirby Co. (All of Cleveland)

General Petroleum Building, Los Angeles, Calif.

Lightweight Concrete With POZZOLITH Provides STRENGTH With Less Weight

In an effort to reduce total structural weight and also to slash cost of form work, the architect and engineer for the General Petroleum Building in Los Angeles turned to lightweight concrete. *Pozzolith* was employed to obtain the necessary workability and specified strength for floor slabs and beams. With pumice aggregate and *Pozzolith,* the mix was readily placed and finished with little or no tendency to bleed or segregate and the reduced weight of this concrete achieved a 30% savings in the cost of form work. In the hardened state, the lightweight concrete presented a smooth, even surface free from cracks or honeycomb. Field service by The Master Builders Co., Los Angeles Office.

Archt.: Wurdeman and Becket.
Consult. Engr.: Murray Erick Associates.
Contr.: P. J. Walker Company.
Pozzolith Ready-Mixed Concrete: Wailes & Bageman Inc., and Consolidated Rock Products Co. (All of Los Angeles)

Lightweight Concrete With POZZOLITH Used In Construction Of Two Beautiful Bank Buildings

CONTINENTAL NATIONAL BANK BUILDING

Ft. Worth, Texas

Archt.: Preston M. Geren, Ft. Worth.
Gen. Contr.: Rambo Construction Company, Ft. Worth.
Concrete Contr.: Joe Adams & Son.
Pozzolith Ready-Mixed Concrete: Fort Worth Sand & Gravel Co.

FULTON NATIONAL BANK BUILDING

Atlanta, Georgia

Archt.: Wyatt C. Hedrick, Inc., Dallas.
Assoc. Archt.: Moscowitz, Willner & Millkey, Atlanta.
Contr.: Henry C. Beck Company, Atlanta.
Pozzolith Ready-Mixed Concrete: MacDougald–Warren Co., Atlanta.

DALLAS MEMORIAL AUDITORIUM

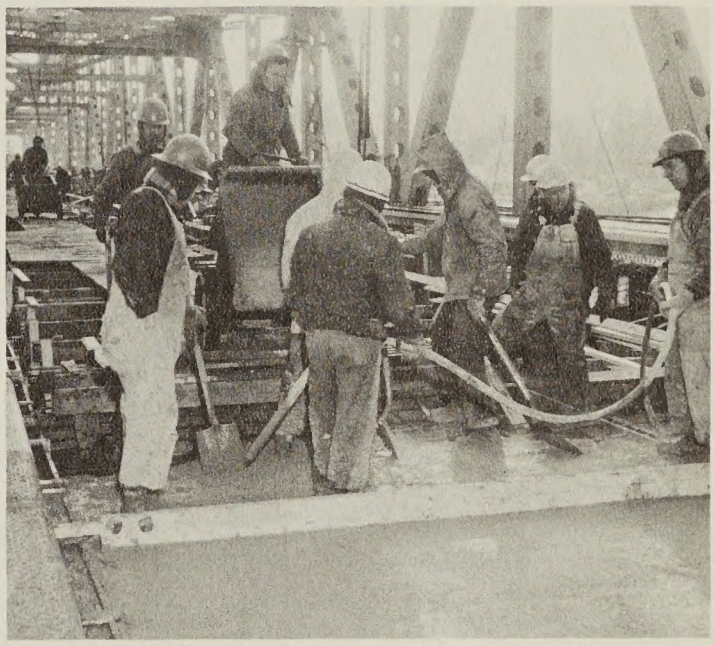
Archt. & Engr.: George L. Dahl, Dallas, Texas.
Consult. Engr.: Ammann & Whitney, New York.
Gen. Contr.: R. P. Farnsworth & Co., Dallas & New Orleans.

Pozzolith used here in lightweight concrete dome roof. (Full story in Master Builders Reporter No. 12, Stadiums & Auditoriums.)

BARNHART ISLAND BRIDGE

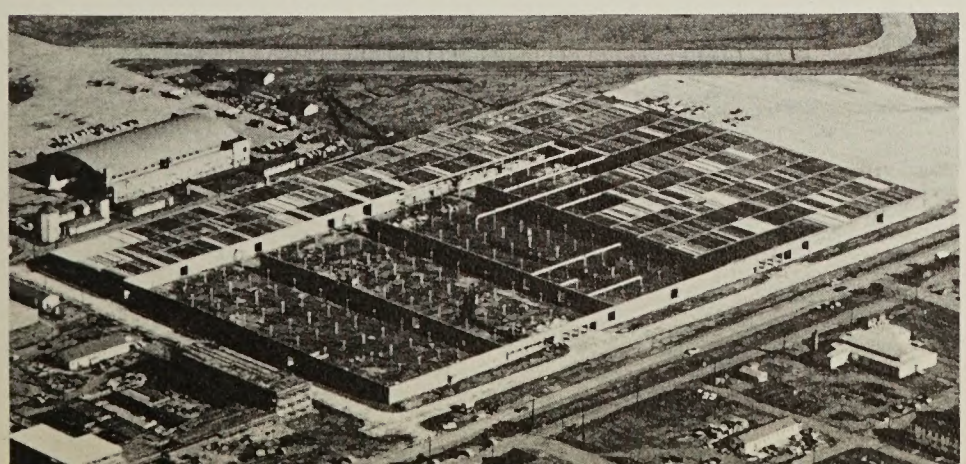
Owner: Power Authority, State of New York.
Designer: Praeger-Kavanagh, New York City.
Substructure: A. S. Wikstrom Inc., Skaneateles, N.Y.
Superstructure:
Fabricators: Mount Vernon Bridge Co.
Erectors: American Bridge Co.
Concrete Approaches and Deck: Winco Constructors, Syracuse, N.Y.

Lightweight concrete bridge deck placed at near zero temperature with the aid of *Pozzolith* High Early. (Complete concrete story in Master Builders Reporter No. 11, Bridge Concreting.)



CIVIL AERONAUTICS ADMINISTRATION WAREHOUSE

Pozzolith employed in production of prestressed lightweight concrete double T units, for 16 acre roof. (Story in Master Builders Reporter No. 13, Prestressed Concrete.)



Owner: Oklahoma City Airport Trust.
Archt.: Hudgins, Thompson, Ball & Associates.
Contr.: Dan Tinkersley & Associates.
Prestressing: Thomas Concrete Pipe Company.
(All of Oklahoma City)

AVERY CLASSICS

field experience confirmed by leading concrete authorities

The superior qualities and economy of concrete produced with *Pozzolith* have been fully established during 25 years of field experience, such as shown in this folder, and in extensive tests made by many government, professional and private laboratories. These studies show the following advantages for concrete made with *Pozzolith:*

For Standard Weight Concrete

At Equal Slump

- INCREASED STRENGTH . . . up to 25%.
- REDUCED BLEEDING . . . approximately 50%.
- INCREASED DURABILITY . . . up to 400% greater resistance to freezing and thawing and increased corrosion resistance.
- REDUCED PERMEABILITY . . . as much as 80%.
- INCREASED BOND-TO-STEEL . . . up to 40%.

At Equal Water-Cement Ratio

- INCREASED WORKABILITY . . . added to a plain, workable mix, *Pozzolith* increases slump up to 150%.

At Equal Strength and Placeability

- REDUCED COST-IN-PLACE OF CONCRETE . . . with proportionate improvements in concrete properties in both plastic and hardened state.

The improved quality of *Pozzolith* concrete and its lower cost-in-place result from:

control of water content . . . Pozzolith makes possible lowest water content for a given workability.

control of rate of hardening . . . Pozzolith provides desired time for handling, placing and finishing under widely varying job conditions.

control of entrained air . . . Pozzolith provides optimum air content without sacrificing strength or other desired qualities.

Similar benefits are obtained with lightweight aggregate concrete.

How To Get These Benefits For Your Project

Your assurance of top results with *Pozzolith* is based on our half century of experience in concrete—available through your Master Builders field man. This experience includes a broad knowledge of concrete-making materials in your area and elsewhere, and what you can expect from these materials and *Pozzolith* under job conditions.

Master Builders men are assisted by the company engineering and research staff — unexcelled in our industry — in the investigation and solution of unusual field problems. They work closely with commercial testing laboratories to achieve the common goal of uniform, better quality concrete.

There are more than 100 men in our field organization. These seasoned, full-time Master Builders field men are located in all principal cities. We invite you to call on one of these men to demonstrate the advantages of *Pozzolith* for your current work.

Ask us to demonstrate the advantages of Pozzolith *for your project.*

Three reasons for wide and successful use of POZZOLITH

1. PROVED PERFORMANCE . . . in excess of 156 million cubic yards of concrete produced with *Pozzolith* for all types of jobs.
2. APPLIED KNOW-HOW . . . more than 100 full-time Master Builders men provide valuable product-use know-how.
3. AVAILABLE EVERYWHERE . . . over 1500 ready-mix and job-site plants now producing concrete with *Pozzolith.*

COLORED MOTION PICTURE shows how *Pozzolith* and its adaptations greatly improves your control of concrete quality. Film available for private showing to groups of any size.

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